+.9 Course
Ag 81 Ecp Control of plant diseases.
Lecture 16

SWEET POTATO - L. L. Harter
Lecture 16.

Disease Control

1. Adaptation to temperature and subtropical climates. Perennial in tropics. Annual in U. S., vegetatively reproduced.

2. Crop value

2. Methods of growing the crop - hotbed, storage, slip seeding, etc.

3. Losses from diseases - field, hotbed, storage.

4. Major parasitic diseases: Black rot (Cerotostomella fimbriata), wilt (Fusarium oxysporum), Foot rot (Plenodomus destruens), Texas foot rot (Phymatotrichum omnivorum), scurf (Monilochaetes infuscans), mottle necrosis (Pythium butleri), root-knot (Caconema radicicola).

5. Non-parasitic diseases: Mosaic, growth cracking, fasciation, sunscald.

6. Disease control.
   - Hotbed sanitation - clean soil or sand
   - Seed-potato selection (discard blemished potatoes)
   - Seed potato treatment (Mercuric chloride, formaldehyde, Phenol mercury compounds)
   - Crop rotation
   - Slip seeding
   - Soil treatment (sterilization by dry steam and chemicals)
   - Chemical treatment of plants (sulphur, Bordeaux, etc.)
   - Multiple plants per hill
   - Resistant varieties
   - Breeding for resistance

Collateral Reading

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MARTIN, W. H. Sweet potato disease studies. Ann. Rept. New Jersey Agr. Exp. Sta. 50 (1928-1929). p. 256-260. 1929.

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BEANS

L. L. Harter

DISEASE CONTROL

Lecture 16.

1. Bean industry - Dry shell beans, market garden beans, canning beans, Lima beans,

2. Crop value - Grown for home use and commercially.

3. The seed industry, and its relation to the prevalence of disease.

4. Losses due to diseases - estimated.

5. Major diseases:

   (a)Beans (Phaseolus vulgaris), Blight (Bacterium phaseoli), Anthracnose (Colletotrichum lindemuthianum), Root rots, Mosaic, Powdery Mildew (Erysiphe polygoni), Rust (Uromyces appendiculatus), Angular leaf spot(Isariopsis griseola), Ashy stem Blight(Macrophoma phaseoli) and others.

   (b)Lima Beans(Phaseolus limatus),Pod Spot(Diaporthe phaseolorum), Downy Mildew (Phytophthora phaseoli), Bacterial Spot(Bacterium viridifaciens), Yeast Spot (Nematospora phaseoli), Cercospora leaf spot(Cercospora cruenta).

6. Control - Seed borne diseases

   Fungicides - Sulphur dusting for mildew.
   Seed treatment - experiments, materials, etc.
   Varietal resistance - Blight, Anthracnose, Rust. Mosaic,etc.
   Disease free seed, western grown seed. Regions, diseases,etc.
   Crop rotation
   Breeding for disease resistance -- Examples.

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PEAS

L. L. Harter

Lecture 16.

DISEASE CONTROL

1. Pea industry similar to that of the bean

2. Crop value

3. Losses due to diseases - estimated.

4. Major Diseases:, Ascochyta blight (Mycospharella pinodes), Root Rot, (Fusarium martii var. pisi), Stem Blight (Bacterium pisi), Anthracnose (Colletotrichum pisi), Septoria Blight (Septoria pisi), Powdery Mildew (Erysiphe polygoni), Downy Mildew (Peronospera viciae), Wilt (Fusarium orthoceras var.pisi).

5. Control - Seed borne diseases

   Fungicides.-Spraying with bordeaux and dusting with sulphur recommended for powdery mildew.

   Crop rotation
   Seed treatment
   Breeding for disease resistance
   Varietal resistance
   Disease free seed

COLLATERAL READING

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Walker, J.C. Resistance to Fusarium Wilt in garden canning and field peas. Wis. Agr.Exp.Sta. Bull. 107,1931.

Jones, L.K. Studies of the nature and control of blight leaf and pod spot and footrot of peas caused by species of ascochyta. N.Y.State Agr.Exp.Sta.(Geneva)Bull. #547,1927.

_____ Factors influencing the effectiveness of organic mercury dusts in pea-seed treatment. J.A.R. 42:25-33. 1931.

CRUCIFERS (CABBAGE, TURNIPS, ETC). L. L. Harter

DISEASE CONTROL Lecture 17.

1. Crops included among the cruficers - cabbage, turnips, cauliflower, Brussel sprouts, Kohl-rabi, collards, kale, radishes, rape, broccoli.

2. Economic importance of crucifers

3. Many diseases of crucifers the same.

4. Major diseases: Yellows (Fusarium conglutinans), - black leg (Phoma lingam), club root(Plasmodiophora brassicae), leaf spots (several), root rots (several). Leaf spots generally not severe enough to require control measures. No control for root rots.

5. Control. Seed borne diseases (black leg, black rot).
Fungicides
Seed bed sanitation - use disease free soil or sterilize.
Crop rotation.
Use disease free seed - Seed grown commercially about Puget Sound, on Long Island and in Europe.
Breeding and Selection - Yellows resistant Work at Wisconsin-Iowa.
Soil treatment - club root
Seed treatment

COLLATERAL READING

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Wellman, F.L. Clubroot of crucifers. U.S.Dept. of Agr. Tech.Bull.181.1930.

Clayton, E.E. Seed treatment for diseases of cruciferous crops on Long Island. N.Y. Agr.Exp.Sta.Bull,537 (Geneva) 1927.

ONIONS - L. L. Harter

Lecture 17.

Disease Control

1. Economic importance and other facts about the onion.

2. Important onion diseases
   - Smut (Urocystis cepulae)
   - Mildew (Peronospera schleideni)
   - Pink root (Phoma terrestris)
   - Fusarium rot (Fusarium sp.)
   - Rust (Puccinia porri)
   - " asparagi)
   - White rot (Sclerotium cepivorium)

3. Diseases important in storage and transit.

   - Neck rot (Botrytis spp.)
   - Soft rot (Bacillus carotovorus)
   - Black mold (Aspergillus niger)
   - Smudge (Colletotrichum circinans)

4. Control of onion diseases

   - Soil treatment - smut
   - Fungicides - mildew
   - Crop rotation
   - Clean seed beds - pink root
   - Sorting out diseased bulb, proper curing & storage.
   - Storage.

Collateral Reading

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WRIGHT, R. C. Some effects of freezing on onions. U.S. Dept. Agr. Cir. 415. 1927.

SPINACH - L. L. Harter

Lecture 17.

Disease Control

1. The industry - crop value, growing centers, etc.

2. Important spinach diseases:
   Blight (mosaic - cause undetermined,
   Downy mildew (Peronospora effusa)
   Leaf spot (Heterosporium variable)
   Anthracnose (Colletotrichum spinaciae)

3. Control measures

   a. Resistant strains - blight
   b. Soil reaction
   c. Fungicides
   d. Crop rotation - soil drainage, etc.

Collateral Reading

McCLINTOCK, AND SMITH, L.B.. True nature of spinach blight and the relation of insects to its transmission. J.A.R. 14:1-60. 1918.

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ASPARAGUS - L. L. Harter

Disease Control Lecture 17.

1. The industry, crop value, distribution, etc.

2. Important diseases:
   Rust (Puccinia asparagi)

3 Control:
   Resistant varieties - Martha Washington, Mary Washington.
   Fungicides - use and limitation.

Collateral Reading

CHUPP, CHARLES. Manual of Vegetables.Garden Diseases. 1925.

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CONTROL OF DISEASES IN FOREST NURSERIES

Lecture 24
Carl Hartley
Dec. 14,1931.

Forest nursery business not large but nursery conditions abnormal for forest species and disease consequently troublesome. Offers almost the only chance for direct disease control in silviculture.

BROAD LEAVED TREES. Little used in forest planting. Of the diseases that appear in severe form, horse chestnut leaf blotch and presumably oak mildew controllable by sprays or dusts. No known control for locust seed bed diseases or germination loss and collar rot of oaks. (Cornell Bull. 371; New Jersey Circular 197; Rankin, Manual of tree diseases.)

CONIFERS.

Germination loss and damping off (mainly Pythium and Rhizoctonia).
Control of moisture, temperature and stand density insufficient.
Seed treatments ineffective.
Soil treatments good. (U. S. Dept. Agric. Bull. 169, 453; 1928 Yearbook, p.532; Cornell Memoir 124; Ohio Bimonthly Bull. 12:45; Jour. Agric. Research 36:269)
Amendments; lime and wood ashes harmful; sand, subsoil, forest humus, sugar, aluminum sulphate.
Fertilizers neutral or harmful.
Steam disinfection, high and low pressure. Reinfection danger and counter inoculation; time and equipment drawbacks; grub control. (Forest Worker 6: 5; Jour. Forestry 28: 42.)
Chemical disinfectants.
Report as amount per unit surface.
Formaldehyde best in some situations.
Heavy metals, Zn, Cu (salts, colloid, Bordeaux), Hg (organic or inorganic), partly satisfactory.
Acids (mineral, oxalic, acetic) and acidic salts. Aluminum sulphate best material at most nurseries thus far; disinfectant or amendment?
Acids and metals fixed in surface soil. Conifers tolerant but legumes in rotation less so. Frequent watering if used on poorly buffered soils. Dosage to be reduced in use on successive crops.
Weed and grub control.
Probable future treatment; acidification where needed, to Ph 5.5 or further; organic disinfectants in the few places where damping off is important on acid soils, or steam if weeds or grubs are also important.

Needle and twig diseases. Lophodermium controlled in Europe by Bordeaux, spray better than dust (Forstarchiv. 6:303). Septoria blight of southern longleaf pine best prevented by lime sulphur. Spreaders important on conifers. Casein soap has fungicidal capacity. Phomopsis of cedars poorly controlled by usual fungicides, better by colloidal sulphur.

Moulding under long snow cover. Phacidium on spruce, Botrytis on Douglas fir, at high altitudes or latitudes. Spray with lime sulphur before snow-fall (Bordeaux fails or injures). Keep snow off of beds by plank covers or hasten melting in spring by sprinkling with black soil. (Phytopath. 9:521-31; 19:91; Jour. Agr. Res. 24:741-748).

Drouth in 2nd year seedbeds. Difficulty in diagnosis rather than in control. Use of less seed per bed, and in some localities irrigation. (U. S. Dept. Agr. Bull. 44).

Basal heat lesions. On first-year stock, partial shade, frequent watering, fall or early spring sowing, dense stands. In transplants, set stem leaning to south. Light colored and compact surface soil (Jour. Agr. Res. 14:595-604; Phytopath. 11:485-490; Jour. Forestry 37:949-975.)

Chlorosis. In centers of crowded 2-4 year old spruce seedbeds, usually corrected by nitrogen addition. In calcareous soil ferrous sulphate spray. (Jour. Agr. Res. 21:153-171).

Frost. Heaters, mulch, sprinkling at night.

Winterkilling. Fairly dense stand. Mulch, with caution.

Additional literature:

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White, R. P. Nursery disease notes. A mimeographed series issued by the New Jersey Agric. Exp. Sta.

CONTROL OF DISEASE IN THE FOREST

Lecture 25
Carl Hartley
Dec. 16, 1931.

White pine blister rust the only example of continuing large scale direct control of a forest disease.
- Eradication of advance infection of pine.
- Eradication of alternate hosts.
  - Emphasis on dangerous species and localities; scout and crew methods; use of chemical weed killers.
  - Areas and costs. Limitations of Ribes density and pine value.
- Achievements and prospects, 4 regions. Importance of the hosts involved.

Early attempts on chestnut blight; spread delayed but control impracticable. Salvage and intensive search for resistant kinds.
- An example of what may occur to any of our forest species.

Impracticability of large-scale direct action against most forest diseases. Indirect control possible only for stands under active management.
- Most of the indirect methods in the following require further investigation before reduction to practice. Attention to the stand rather than the individual tree.

Trunk rots. (The most serious type of loss, causing either cull or premature death.)
- Decrease infection courts, by prevention of fire and logging scars, avoiding sprout reproduction in some species, and control of branch stubs through stand density.
- Anticipate heavy losses, by logging before stands reach age of heavy decay; cut scarred trees at a lower age than sound trees.
- Take particular care to keep fire out of stands once scarred, since subsequent fires often burn down trees with decay in butt.
- Minimize losses in logging badly decayed stands, by intelligent selection of trees that it will pay to fell, and intelligent bucking.

Plantation diseases.
- Clean planting stock from nurseries protected from local needle blights by spraying, and from diseases in general by removal from the nursery neighborhood of diseased trees or of alternate hosts of stem rusts.
- Choice of site free from infection sources of killing or growth-reducing diseases, or which can be economically made free by fire or mechanical means.

For all parasitic diseases:
Mixed stands for most species.
Sanitation; clause in timber sale contracts.
Genetics in planting and selective logging; chestnut blight.

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_____ Mistletoe injury to conifers in the Northwest. U. S. Dept. Agr. Bull. 360, 39 p. Dec. 1916.

_____ The control of mistletoe by pruning. Jour. Forestry 21: 504-505. May, 1923.

_____ and E. E. Hubert. A study of heart-rot in western hemlock. U. S. Dept. Agr. Bull. 722. 37 p. 1918.

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Gravatt, G. F. and L. S. Gill. Chestnut blight. Farmers' Bull. 1641. 18 p. Illus. Nov. 1930.

Hartley, Carl. Forest genetics with particular reference to disease resistance. Jour. Forestry 25: 667-686. Oct. 1927.

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CONTROL OF FUNGOUS INJURY TO FOREST PRODUCTS

Lecture 26
Carl Hartley
Dec. 18, 1931.

A. PRODUCTS AFFECTED: Logs, poles, piling, posts, lumber, wood in construction, paper pulp, wall board.

B. TYPES OF DEFECT:
   1. Surface molds and deep stains of sapwood due to Ascomycetes.
   2. Decays caused by Hymenomycetes.

C. LOSSES: Probably greater than the losses from fungi attacking the living forest; degrade due to stains of the order of 10 million dollars a year; decay losses running into hundreds of millions, though less than those in U. S. Dept. Agric. Statistical Bull. 21, p. 18.

D. LESS IMPORTANT CONTROL MEASURES: Choice of felling season, prompt milling, cold storage, water storage.

E. CONTROL BY LOW MOISTURE CONTENT: Moderately fast drying to 20 per cent or below by air seasoning or kiln drying; subsequent protection from water.

F. HEATING: Kiln drying, steam box, steam seasoning, tank and factory heating. Not always effective, causes some mechanical degrade, and possibly increases digestibility for fungi.

G. SURFACE ANTISEPSIS AGAINST STAIN AND INCIPIENT DECAY: Alkali or fungicides against stains and molds; requirements severe. Soda, borates, ethyl mercury compounds, chlorinated phenolates, fluorides, organic sulphides. On logs as well as lumber and timber. (Progress in the use of chemical treatments to protect stored logs from deterioration. Amer. Lumberman No. 2926, p.46-48, June 13, 1931; Prevention of sap stain and mold in southern woods by chemical treatment. So. Lumberman 142: 42-45,46. Feb.1931; The control of sap-stain, mold and incipient decay in green wood with special reference to vehicle stock. U.S. Dept. Agric. Bul. 1037. 55 p., illus. Aug. 1922.)

H. IMPREGNATION WITH FUNGICIDES: (effective also against termites)
   1. Creosote the standard; fractions, diluents, permanence, failures.
   2. Soluble salts where appearance or paintability are important.
   3. New commercial materials; gases.
   4. Application processes:
      (a) Immersion; perforation; 1 or 2 baths; boiling.
      (b) Pressure and vacuum; pre-drying or steaming.
      (c) Longitudinal, in dead and living trunks.

5. Incidental effects of heat in impregnation; weakening; disinfection.
6. Preservatives precipitated in the wood; no process yet well established, in trial stage.
7. Preservation industry well developed for large material but poorly for lumber.
8. Refractory timber species, white oak, Engelmann spruce, Douglas fir, cedar.

I. Building rot problem: Infection type; prevention; eradication. Building heating; tank steaming. (Univ. Idaho Bull. 24, no. 2, Jan. 1929; F. J. Hoxie. Decay of wood in industrial buildings, 1930.) (Inspection Department, Associated Factory Mutual Fire Insurance Companies.); The Alabama Polytechnic Institute, Extension Service, Circ. 78, Feb. 1925; The Octagon, Vol. 3, no. 6, p. 3-7, 1931; Vol. 3, no.3, p.9-13.

J. Antisepsis in pulp and pulp products.

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Control of decay in pulp and pulpwood. U. S. Dept. Agric. Bull. 1298, 80 p. Illus. Apr. 1925.

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_____ An outline of forest pathology.- Wood pathology, p. 449-531. New York, 1931.

Decays and discolorations in airplane woods. U. S. Dept. Agric. Bull. 1128. 51 p. Illus. Feb. 1923.

Lecture 27
December 21
H. B. Humphrey

CEREAL SMUTS:

Bunt - Its Control:
Cause: Tilletia tritici, T. levis
Distribution: Coextensive with wheat culture, but each species is more or less regional
Relation of weather to control
Relation of crop practice to control: Edaphic conditions
Physiologic-form specialization
Relation of physiologic-form specialization to control
Seed treatment as a control measure
Copper sulphate; formaldehyde; copper carbonate; certain mercuric fungicides, such as Uspulun, Ceresan, Semesan; etc.
Breeding and selection: Theoretically, the ultimate and only permanent control measure. Actually, may never be accomplished.
Why?

Loose Smut of Wheat and Rye:
Weather factors in relation to loose smut
Varietal susceptibility
Essential life-history differences between the loose smut and bunt organisms
Host invasion of each
Control of loose smut: Why can it not be prevented by fungicidal treatment of the seed?
The seed-plot method
Breeding and selection
Desirability of combining in one variety resistance to loose smut and bunt where both smuts limit production

Flag Smut of Wheat and Stem Smut of Rye:
Control by seed treatment
Control by breeding and selection
Relation of edaphic conditions to development and spread

Oat Smuts;
Loose smut (Ustilago avenae) and covered smut (U. laevis)
Control by seed treatment
Wet treatments. Dusts
Varietal susceptibility - Markton, Fulghum compared with Green Russian, Victory, Liberty Hulless

Barley Smuts:
Covered smut (Ustilago hordei), loose smut (U. nuda)
Control measures for each - wet treatments; dust fungicides; difficulties
Varietal susceptibility to covered smut
Control by breeding and selection

Corn Smuts:
Common smut (Ustilago zeae), head smut (Sorosporium reilianum)
Etiology of each
Control: Seed treatments, sprays, breeding and selection, physiologic specialization

Sorghum Smuts:
Head smut (Sorosporium reilianum), kernel smuts (Spacelotheca sorghi, and S. cruenta)
Control measures differ. Why?

(1) Faris, J. A. Factors influencing infection of Hordeum sativum by Ustilago hordei, Amer. Journ. Bot. 11: 189-214. March 1924

(2) Gaines, E. F. Wheat varieties resistant to stinking smut. U. S. Yearbook of Agriculture. 964: 769-772. 1926

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(11) Potter, Alden A. Head smut of sorghum and maize. Journ. Agr. Res. 5: 339-372. 1914.

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Lecture 28
December 23
H. B. Humphrey

CEREAL RUST AND THEIR CONTROL:

Stem Rust (Puccinia graminis):
Distribution; host range; seasonal and regional occurrence and spread
Factors affecting occurrence and spread
Hibernation of spores (urediniospores) (teliospores)
Hibernation of mycelium: Where? Under what conditions?
Relation of wild-grass hosts to spread of stem rust to wheat, etc.
Relation of alternate host to recurrent epiphytotics
South-to-north march of urediniospores
Relation of cyclones to spore distribution and precipitation and the incidence of epiphytotics

Physiologic specialization

Discovery: European and American contributions.
Relation of barberry to physiologic specialization

Control by means of fungicidal dusts
Control by means of breeding and selection
Control by means of eradication of alternate host

Leaf Rusts of Wheat (Puccinia triticina); Barley (P. anomala); Rye (P. dispersa):

Leaf rust of wheat:
Distribution; host range; seasonal and regional occurrence and spread. Factors affecting same.

Physiologic specialization
Control by means of fungicidal dusts; breeding and selection

Stripe Rust (Puccinia glumarum):
Distribution (world), (American); incidence and spread
Hibernation; host range; urediniospore viability; weather factors

Physiologic specialization - physiologic "varieties" and forms

Control
Resistant varieties; dusting; soil sanitation

(RUSTS)

Crown Rust (Puccinia coronata):
Distribution; incidence; spread
Hibernation; host range; alternate hosts; weather factors

Physiologic specialization

Control
Varietal resistance; dusting; eradication of alternate hosts; adoption of resistant varieties in winter-oats States

Flax Rust (Melampsora lini):
Distribution; hibernation; nature of damage done
Factors affecting epiphytotics
Varietal susceptibility; weather

Control
Soil sanitation; breeding and selection for resistant varieties

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Lecture 29.
H. B. Humphrey

CEREAL DISEASES OTHER THAN SMUTS AND RUSTS:

Scab (Gibberella saubinetii):

Economic importance; distribution; host range

Etiology
Seedling blight, head blight, root, stalk, and ear rot

Control
Seed treatment; destruction of crop refuse; soil sanitation

Foot Rots (Helminthosporium sativum), (Leptosphaeria herpotrichoides), (Ophiobolus graminis):

Relative importance and distribution of each

Relation of temperature and humidity to development of Helminthosporium foot rot and take-all

Control of Helminthosporium foot rot
Seed treatment; soil sanitation
Breeding and selection for resistance
Difficulties in the way - mutation; crop practice

Control of take-all
Crop rotation; fertilizers; soil sanitation

Oat Blast:

Cause (unknown); various theories

Distribution; economic importance

Factors affecting development and control
Temperature, of soil, of atmosphere, soil aeration
Soil moisture, date of seeding
Varietal susceptibility

Helminthosporium Diseases of Barley: Stripe (H. gramineum), net blotch (H. teres), and spot blotch (H. sativum), foot rot (H. sativum)

Etiology of each disease

Relation of growth factors to development and control of each disease

Soil temperature, soil moisture, atmospheric humidity

Varietal susceptibility

Seed treatment, crop rotation, tillage

Colletotrichosis of Rye and Wheat:

Cause; distribution; etiology

Control

Ergot:

Cause, distribution, host range, economic importance

Control

Clean seed; crop rotation; soil sanitation

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Lecture 30
H. B. Humphrey

DISEASES OF CEREALS OTHER THAN SMUTS AND RUSTS;

Diseases of Corn:

Diplodia ear rot of corn:

Economic importance, distribution
Etiology
Control
Seed treatment, crop sanitation

Cephalosporium black-bundle disease; Stewart's disease; soil-deficiency disturbances; downy mildew; brown spot (Physoderma):

Economic importance and distribution of each
Methods of control

Diseases of Rice:

Straighthead:

Cause, distribution, and economic importance
Control

Brusone disease; false smut; sclerotium stem rot:

Control

Diseases of Flax:

Wilt:

Distribution and economic importance
Control

Pasmo:

Distribution and economic importance
Control

Rust:

Distribution; economic importance
Control

Heat Canker:

Factors causing same; distribution; importance
Control

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GRADUATE SCHOOL
Control of Plant Diseases

Lecture 44
John Monteith, Jr.

GRASSES AND TURF

Grasses as forage crops

For hay, ensilage, and pasture. Frequently grown in mixtures of different grasses or with legumes. Little studied with scientific methods.

Grasses for fine turf

Problems in many ways similar to pasture problems. Have received somewhat more critical attention and can command more intensive methods of culture and disease control.

Diseases of forage and fine turf grasses

Uncut grass subject to many diseases caused by species of Bacterium, Claviceps, Colletotrichum, Erysiphe, Fusarium, Helminthosporium, Phyllochora, Puccinia, Scleroepora, Septoria, Sclerotium, Ustilago and many others.

Closely cropped grass attacked by species of Agaricus, Fusarium, Helminthosporium, Pythium, Rhizoctonia, Sclerotium and others.

Control measures

Seed treatments, resistant varieties, and early cutting are only control methods that have been reported effective in controlling forage grass diseases. Seed treatments similar to those used on cereals.

Many methods used in controlling diseases of fine turf, some of which might be modified to apply to pasture disease problems. Mercury and copper treatments. Air and soil drainage. Watering. Sweeping to remove dew. Use of fertilizer and lime. Effect of height of cutting. Winter covering.

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GRADUATE SCHOOL
Control of Plant Diseases

Lecture 43
John Monteith, Jr.

FORAGE CROPS - (LEGUMES)

Forage crops in Agriculture
Less scientific information available in this group than on any other important cultivated plants. Usually not regarded as cash crop and therefore not studied critically.
Two principal groups - legumes and grasses

Diseases of leguminous forage crops:
Leaf diseases - caused by numerous fungi such as species of Ascochyta, Cercospora, Colletotrichum, Erysiphe, Gloeosporium, Peronospora, Phyllosticta, Pleosphaerulina, Pseudopeziza, Uromyces.
Stem, crown, and root diseases - caused by species of Sclerotinia, Fusarium, Rhizoctonia, Ozonium, Colletotrichum, Gloeosporium, Urophlyctis, Pseudomonas
Nonparasitic diseases - such as winter injury, clover sickness, mosaic, yellow-top.

Control measures
Nature of crop imposes limitations on control measures.
Resistant varieties offer most practical control.
Crop rotation and use of lime or fertilizers give some relief.
Cultural practices such as deep plowing, time of sowing or cutting, use of nurse crops, protection from contamination from nearby fields may be of some help.
Clean seed avoids spread of some diseases.
Burning small infested areas may be effective on limited scale.
Spraying, dusting and seed treatment not often practical.

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